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A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LII
No. 1354

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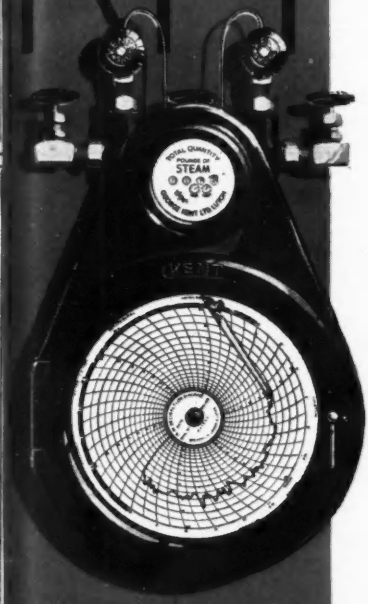

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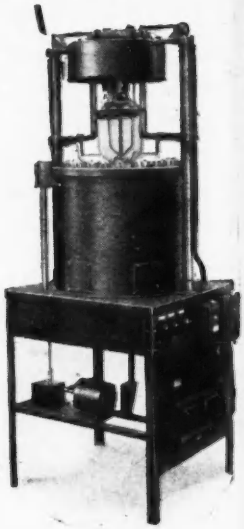

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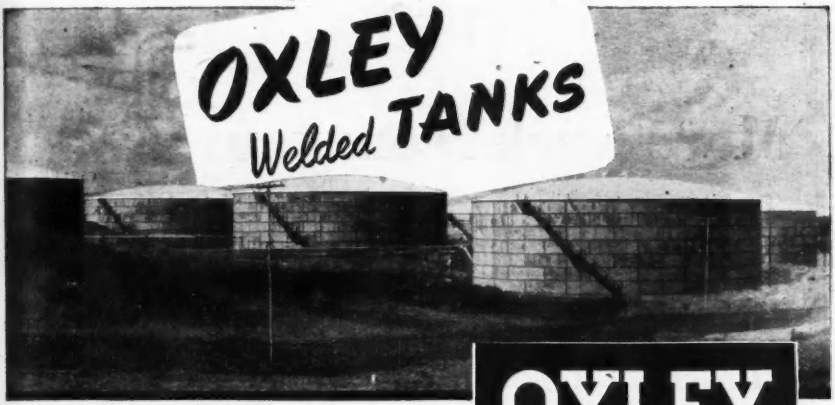

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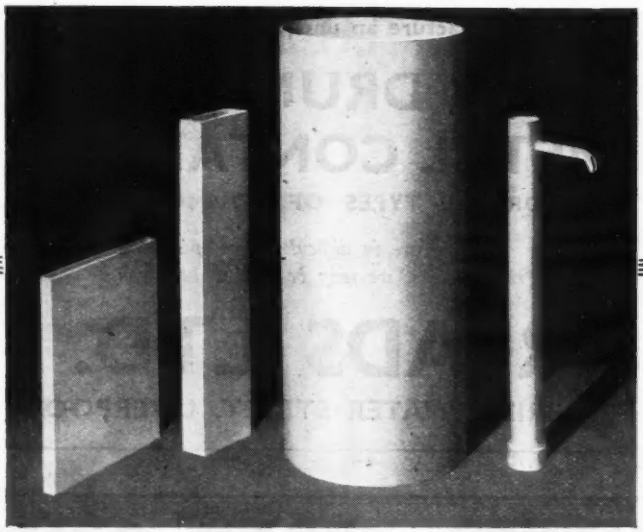

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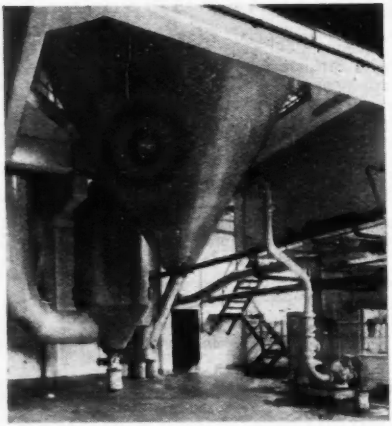

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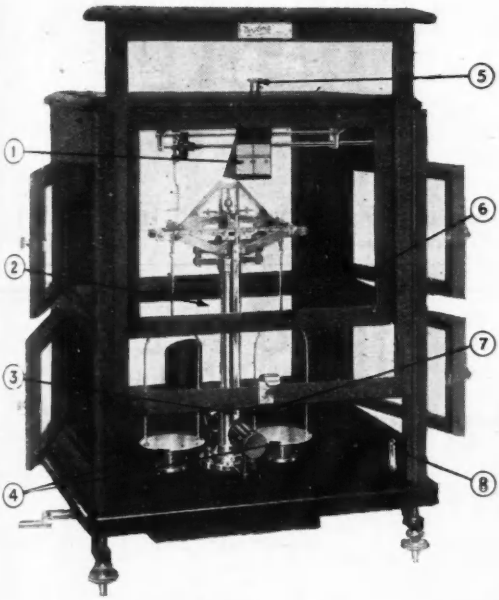

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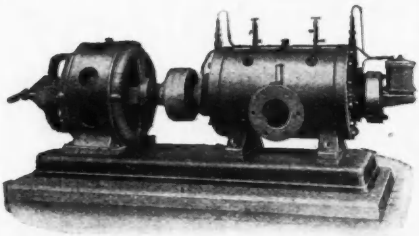

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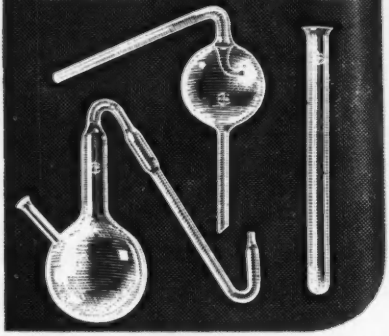

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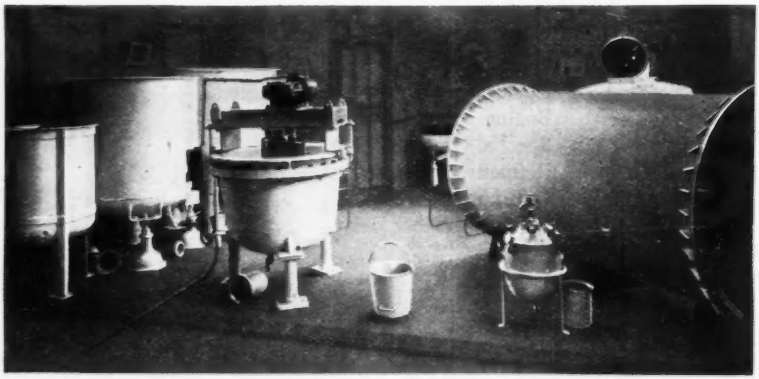

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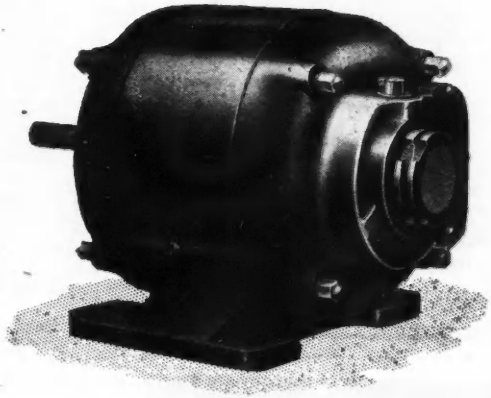

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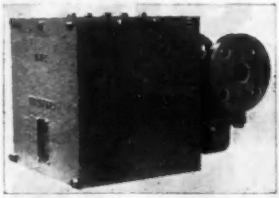

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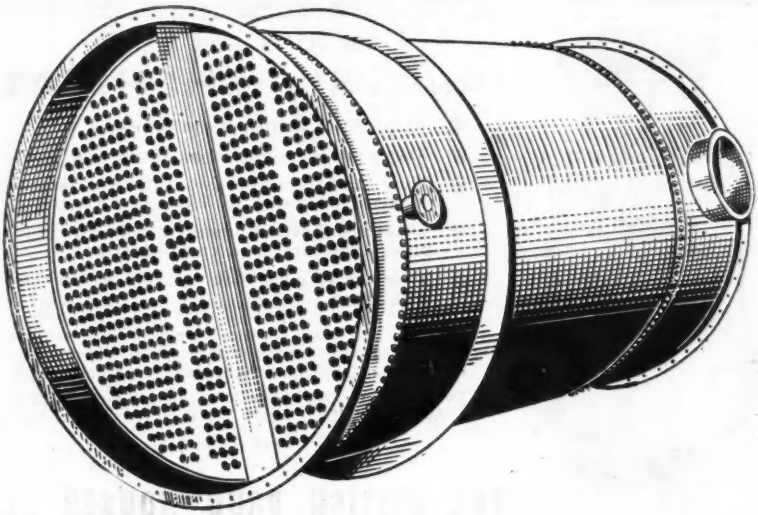

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June 9, 1945

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Ammonia Synthesis from Coke-Oven Gas

SYNTHETIC ammonia is one of the weapons of war. In time of warfare the cost at which the ammonia is produced does not matter. In time of peace the ammonia is turned into sulphate of ammonia or other fertiliser and clearly it must have a reasonable market price. One result of the need for explosives in the last war was the creation of the great synthetic ammonia plant at Billingham. A by-product from this plant was a complete change in the ammonia position in the carbonising industries. In 1914 ammonia was the principal by-product from coke ovens and was a very important by-product from gasworks. After 1918 it was produced largely at a loss or perhaps, in certain circumstances, at a small profit. Synthetic ammonia controlled the market and we shall probably be right in saying that by-product ammonia only proved to be worth recovering in a marketable form because a policy of live and let live was pursued by those who were responsible for marketing synthetic ammonia.

The demand for ammonia has greatly increased during the past 45 years. Taking the world's total nitrogen production in 1910 as 100, that of 1925 was 230 and that of 1936 was 405. By far the greatest part of this increase was due to synthetic processes, and it is true to say that although the return from ammonia in the carbonising industries has decreased so seriously as to have caused for some years a serious economic disturbance in those industries, the rise of the synthetic processes has filled an important gap which could not otherwise have been filled. It is only natural, and has happened in many other industries, that when a better process which produces an improved material, or which involves lower costs than the existing process, is found, the older process or product must be supplanted. Although the virtual disappearance of ammonia from the credit side of the carbonising balance sheet is to be regretted, it cannot be helped. The clock cannot be turned back.

There are many plants on the Continent manufacturing synthetic ammonia from coke-oven gas, but there is only one such plant in this country, that of Synthetic Nitrogen Fertilisers, Ltd. Some part of this plant, particularly that relating to the production of the synthesis gas, has been described by Mr. J. Watson Napier in a paper to the

On Other Pages

Notes and Comments	495
Raw Materials for Plastics and Synthetic Rubbers—I ...	497
Control Orders Revoked: Fluorspar; Bonding Materials ...	502
Cheaper Thiophene	502
American Patents	503
Newton Chambers Award ...	504
War Damage Compensation ...	505
Letter to the Editor: DDT and Gammexane	505
Personal Notes	506
Pest Control	506
Parliamentary Topics	507
General News from Week to Week	507
Forthcoming Events	509
Commercial Intelligence ...	509
Company News	509
Stocks and Shares	509
British Chemical Prices ...	510

Chemical Engineering Group and the Institution of Chemical Engineers. It is quite clear from this paper that the processes of liquefaction, etc., by which the hydrogen and the nitrogen are produced are important, and not over-easy to control. Mr. Napier is to be congratulated upon a remarkably lucid description of the plant and evidently upon considerable skill in its management. The designers of the plant are also to be congratulated on an eminently workable unit. We do not propose here to discuss the technical aspects of this plant. We are interested in its more general application in this country. It is hardly to be expected that at this stage Mr. Napier could have made a detailed appraisal of the value of the synthesis from coke-oven gas as compared with other methods of producing ammonia, such as that from the semi-water-gas process. He contents himself by pointing out that hydrogen from coke-oven gas "is especially economic where power costs are reasonable and where there is an availability of cheap coke-oven gas." There is a great deal of coke-oven gas in the country and one is led to wonder whether the price that can be paid for coke-oven gas as a raw material for ammonia synthesis would be sufficient to cause the coke-oven industry to consider this method of disposing of its surplus gas as compared with present methods, such as the sale for town gas purposes.

No evidence is contained in the paper, nor was given during the discussion, on this important subject, but we suspect from the author's reference to "cheap coke-oven gas" that the synthetic production of ammonia from coke-oven gas can be justified only when the coke-oven gas is really cheap. The capital cost of the plant is high and we were left with the impression that the capital charges are the greatest single factor in the cost of synthetic ammonia by this process. If that is so it would seem that improvements are possible. There may be means of increasing the production per unit of capital employed. It was mentioned, for example, that certain parts of the plant will only continue in operation for a comparatively short time before being stopped for cleaning. Where capital cost is high maximum production per annum is important.

There is, of course, an alternative method of utilising coke-oven gas for chemical purposes, namely to use the hydrocarbons contained in the gas—methane, ethane, ethylene, and the benzene hydrocarbons—for production of chemicals. It was pointed out by Mr. Greenfield that if all these hydrocarbon gases were removed from the gas the remaining hydrogen and CO would be sufficient in thermal value to heat the ovens. As against this if a synthetic process proved to be successful economically the ovens could be heated by producer gas made from low-grade fuel and the whole of the gas could be liquefied, each of the separate fractions obtained being utilised as a chemical intermediate.

It appears to our uninstructed mind rather useful to ponder over the fact that oxygen, methane, ethylene, and other gases produced during the process of making the synthetic mixture for ammonia production are too often *not* utilised for chemical or other purposes. When steps are taken to utilise coke-oven gas completely instead of only its hydrogen content, the value of the gas may be considerably greater. We might at this stage call attention to a passage in a recent paper "The Carbonising Industries after the War," read by Dr. Foxwell to the C.O.M.A. on February 1. "Chemical utilisation of coke-oven gas must be limited in scope by the markets for the products. . . . It involves considerable capital expenditure and a full-time high-grade operating staff. If these processes are to be profitable they must be continually operated at high output; in no sense can chemical utilisation be an intermittent process for utilising spare gas. . . . It would not be an alternative to linkage with the gas industry, but an additional business venture to which both industries should contribute."

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DURING the last three years, the quantity of crude tar distilled in this country has declined, according to figures contained in the Statistical Digest of the M.F. & P. (H.M.S.O., 1s. 0d.), from 2,172,000 tons in 1942 to 2,124,000 tons in the following year and to 2,083,000 tons last year. Compared with 1938, output in 1944 increased by 223,000 tons. Output of creosote oil reached its peak in 1942 with 64,000,000 gallons against 55,000,000 last year. Refined cresylic acid of all grades accounted for 7,056,000 gallons in 1944, compared with 7,242,000 and 6,176,000 gallons in the two preceding years. Output of crude naphthalene has fluctuated between 14,000 and 15,000 tons, while production of the important pyridine bases has shown a decline from 157,000 gallons to 132,000 gallons over the last three years.

Lifting the Fog

ANYONE who read with care the report in *The Times* last week on "Operation Fido," must have been struck by the extraordinary rapidity with which success in fog-lifting was attained. The report states that "up to 1942 most experts pronounced the task to be hopeless," the Prime Minister's minute was dated September 26, 1942, and by November 4 in that year successful experiments had been carried out. Is it likely that a "hopeless" proposition would have been brought to fruition in so short a time if no one had done anything about it before? Should the Petroleum Warfare Department take quite as much credit for "Fido" as it is claiming? The following extract from the Coke Oven Managers' Year Book, 1939, derived from a paper read in April, 1938, by W. L. Boon and G. E. Foxwell, suggests that the gas industry may have had something to do with it.

"Fog Lifting.—Fog is of very considerable hindrance to both civil and military aviation, and attempts are being made to make use of coke for dispersing fog from aerodromes. By the use of directional wireless beam it is possible in foggy weather to bring aircraft to within 50 ft. of the ground in perfect safety, and it has been shown that by the combustion of coke round the windward side of an aerodrome the fog may usually be dispersed up to a height of 60 or more feet above the ground. Fog is not the comparatively simple substance which it appears to be, for meteorological experts recognise several kinds of fog, and it is found that different kinds of fog react in different ways to the establishment of a layer of warm air beneath them. Work is being continued on this project and it is reasonable to hope that a practical solution of the problem of dispersing all kinds of fog will soon be reached."

There were *some* experts at all events who did not consider the problem "hopeless." What we should like to know is: Why was the work discontinued, apparently, between 1938 and 1942; and what were the experts of the D.S.I.R. doing not to recognise its importance?

Planes into Pans

THE recently formed Aluminium Development Association has introduced itself to the public by organising an exhibition at Selfridges to demonstrate the many uses to which this versatile light metal can be put. The services that aluminium has rendered in aircraft production—a fitting tribute was paid to Sir Stafford Cripps and his work at the M.A.P.—need no emphasis. Production capacity has risen from under 500,000 tons yearly before the war to its present level of about 2,500,000 tons, which the Association's executives hope to be able to maintain. The main civilian employment of aluminium is being sought in the building industry, while its use in the construction of rolling stock, ships, and motor-car bodies will also be higher than in 1939. In addition, the heavy pent-up demand for kitchen equipment, for toys, and for decorative purposes must also be taken into account. Although the industry hopes to co-operate with the plastics, timber, and glass industries, it will be interesting to watch the steel industry's reaction. Clearly, at the present cost of £85 per ton, carrying out the Association's plans may not be easy, but it is hoped to reduce the price to £65 per ton within about 18 months. Indeed, it is to be hoped that this young industry will pay every attention to serving the needs both of the domestic and foreign markets, without adopting the restrictive practices of some older industries. It

is to be regretted that none of the industry's representatives found it necessary to convey to the technical Press a more accurate picture of the aluminium industry's war effort and of new technical developments. We allow ourselves to wonder whether any of our foreign competitors, say the American or Swiss producers, would have neglected this opportunity of stressing their technological achievements.

An Alkali Jubilee

IT is just fifty years since the Castner Kellner Company was founded, an event of great significance to the British alkali industry. Hamilton Young Castner, born at Brooklyn, N.Y., came to London in 1886 to establish a small works near Waterloo Bridge. As a boy he had dabbled in chemistry and in electrical experiments—a combination which was to mean much in later years. After a course in chemistry at Columbia College and a period as analyst in New York, he turned his attention first to artificial diamond making, and then, with far greater benefit, to the production of sodium for aluminium manufacture. (Aluminium, the "silver from clay," was made in those days expensively by displacement with the aid of sodium.) Although by accident in his fusion process, using huge steel crucibles for heating caustic soda with iron carbide, Castner produced some small diamonds—or what were thought to be diamonds, though the infallible X-ray test applied successfully to Hannay's products was not then available—it was fortunate that he chose sodium-making as his métier. From London Castner went to Oldbury to work his sodium process with the Aluminium Company there. And although electrolytic aluminium banished this method, he had a second string to his bow, *viz.*, the production of caustic soda and chlorine from brine. He made sodium from electrolytic caustic soda; sodium peroxide for bleaching from his sodium; took out an American patent in 1894 for his well-known mercury cell method for caustic soda; and in 1895 joined with Kellner, an Austrian also engaged in preparing caustic soda and chlorine from brine, to form the Castner Kellner Company which played a leading part in the history of the alkali industry.

The "British Ass." at Work

ONE of the most gratifying effects of victory in Europe, from the point of view of anyone interested in science, will be the resumption of the normal activities of the British Association. No official announcement of forthcoming arrangements has yet been made, but the enterprise and energy of the president, Sir Richard Gregory, are such that we feel safe in anticipating a return to normal at the earliest possible date. These hopes have been brought to mind this week by the appearance of a new number (Vol. III, No. 10) of *The Advancement of Science* (5s.), the organ by whose means the Association has fulfilled its function so well under war conditions. The present number, besides containing reports of the conference with the Indian Scientific Delegation and of that on the Place of Science in Industry, comprises a new feature—the first batch of a series of authoritative articles on Applications of Science, the promotion of interest in which is one of the first functions of the Association. Along with others, these are to be published in the form of separate pamphlets, as circumstances (among them the Paper Controller) permit.

Applications of Science

THE five which have so far appeared are: *Food*, by Professor Marrack; *Water*, by Professor Boswell; *Anthropology*, by Mrs. Quiggin and Professor Hutton; *Fatigue*, by Professor Cathcart; and *Mineral Resources*, by Dr. David Williams. We have read them all with the greatest interest, but the first and the last will be of especial interest to readers of THE CHEMICAL AGE. It is not that there is a great deal that is new in the articles; rather it is for their systematisation of the available facts that they are worthy of study. The survey of malnutrition in Professor Marrack's article has an unhappy topical interest, while perhaps the outstanding feature of Dr. Williams's contribution is the stress he lays on the staggering lack, outside the U.S.A., of accurate information about minerals. His brief survey of geophysical prospecting is also of high interest. In fine, to anyone who has the slightest desire to clarify his ideas about the scientific future, this extremely meaty volume is well worth its price.

Raw Materials for Plastics and Synthetic Rubbers—I

New British Developments Essential

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

DURING the last few years the future of the plastics and synthetic rubber industries has been debated with great vigour and a wealth of speculation. Some of the pictures painted have exhibited features highly suggestive of the scientific romances of a Jules Verne or the early H. G. Wells. Demonstrations of a moulded bed and of a moulded coffin have given rise to fears that plastics will encompass us both in life and death. The future may offer motor cars with moulded plastic bodies and houses where plastics have replaced wood, brick, and mortar.

War-Time Advances

Already during the war the applications of plastics have found extensive use in the actual structure of the aeroplane while the use of plastic bonded plywood in the decks and bulkheads of high-speed motor torpedo-boats foreshadows even greater expansion for the products of this newest chemical industry. Nylon, in the form of toothbrush bristles, had already entered the market before the war and it will almost certainly find vastly extended use in textiles, fabrics, and other fields. Synthetic resins as surface finishes on aeroplanes have played a substantial part in reducing skin friction with consequent increase in speed.

The introduction of the clear transparent acrylate plastics has been a vital advance: sheeting for aeroplane enclosures manufactured of methyl methacrylate resin affords, together with inherent properties of easy shaping, light weight (it is half the weight of glass), and resistance to weathering, and the very wide angle of view in all directions so utterly essential in pilot and gunner cockpits. Equal in importance with the other properties is its resistance to splintering.

Plastic moulded plywood may almost be considered as a completely new constructional material, which may readily be moulded to shape while possessing the weathering and dimensional stability required for even aircraft applications. Fuselages, wings, stabilisers, flooring, and jettison fuel tanks have all been easily constructed from this useful material.

Waterproof fabrics may be mass-produced by the use of resin-coated textile materials, over a million raincoats of these materials having been issued to the U.S. Army, releasing 750,000 lb. of rubber for other more essential purposes.

Polystyrene, a plastic which may be made slightly flexible, has been used extensively as sheathing for electrical cables, particularly for high-frequency cables where low power losses are important. Outstanding electrical properties are associated with polystyrene, which has a power factor of 0.0002 and a permittivity of 2.4.

In 1942, the Japanese conquest of Malaya and the East Indies introduced a completely new and unexpected feature into the war, namely, the seizure by the Axis Powers of practically the entire world resources of natural rubber. Up to 1941 the consumption of rubber in the U.S.A. was about 660,000 tons per annum, while in 1941 the figure had risen to 750,000 tons. To supply the war needs of Britain and the U.S.A. the War Production Board in America estimated that a minimum annual production of one million tons of synthetic rubber would be required. No large-scale plant for synthetic rubber manufacture existed in Britain, while in 1939 U.S. plant was capable of producing only 2500 tons of synthetic rubber. Several of the most vital materials for synthesis, such as benzene, were urgently required for other war purposes, for example, the production of 100-octane petrol.

Chemical Engineers' Task

As the production of this huge quantity of synthetic rubber was literally a matter of life and death for the United Nations, the vast chemical engineering industry in the U.S.A. was given an unprecedented task, the rapid and successful accomplishment of which was essential for military victory. Mr. Bradley Dewey, the rubber director of the War Production Board, reported in June, 1944,[1] that with about fifty plants in operation synthetic rubber was being manufactured at the rate of slightly over one million tons per year. At the same time the average price had been brought down from 40 or 50 cents to 12 cents per lb. A comparison with the 1939 figure of 7 cents per lb. for natural rubber shows that this new industry[2] is almost certain to offer strong competition in the world markets with the return of normal times. It is highly unlikely, to say the least of it, that this gigantic productive capacity in the U.S.A. will be allowed to fall idle when natural rubber again becomes available.

In addition, synthetic rubber may be easily produced in a variety of types especially suited for individual purposes, *e.g.*, with a high resistance to oil, to chemical action, or to a substantial degree of heat. Further developments and improvements will, undoubtedly, occur in the synthetic rubber in-

dustry and it is at least possible that the era of natural rubber is virtually at an end. A minimum period of four years after the end of the war will probably be required[3] to enable moderate production to be resumed in the plantations, during which time the synthetic industry will be able to establish its position. World requirements of rubber in 1950 have been estimated[3] at 1,900,000 tons, a figure which if realised will afford scope for both natural and synthetic rubbers.

In 1943, in addition to synthetic rubber, 420,000 tons of plastics were produced in the U.S.A., the estimated value of the plastics being over £90 million. Actual figures for the various types of plastics and the respective values are given in Table I.

TABLE I

PRODUCTION AND VALUE OF PLASTICS IN 1943 IN THE U.S.A.

Type	*Production in 1000 lb.*	*Value in $1000*
Vinyl resin	86,600	53,260
Polystyrene	3,500	1,120
Nitrocellulose	85,200	22,150
Ethylcellulose	3,900	1,600
Acrylic monomer	36,400	46,400
Phthalic alkyd	147,100	44,130
Cellulose acetate	60,200	34,920
Melamine and urea	123,600	44,990
Cellulose viscose	79,400	35,730
Phenol formaldehyde	283,400	68,010
Casein	41,700	10,430
Totals ...	951,000	362,740

Raw Material Supplies

Supplies of the necessary quantities of raw materials for the synthetic chemical industries have become a predominant factor. As an example, 210,000 tons of raw materials, mainly formaldehyde, benzene, and phenol, were required to produce 126,000 tons of phenolic plastics. Of the million tons of synthetic rubbers, 70 per cent. is composed of Buna-S (or GR-S) pre-eminently suited for tyre treads. Almost 600,000 tons of butadiene are required for the manufacture of this rubber, the butadiene being obtained from alcohols, natural gases, and petroleum refinery gases. The magnitude of the raw-material problem is shown by Elder[4] who estimates that eighty million bushels of corn would be required in the fermentation process to yield the alcohol to furnish 220,000 tons of butadiene per year.

Although maintenance of these enormous production figures is scarcely probable in the years immediately after the war, the output must continue to be large with a continuously expanding market for the products. (Some of the possible lines of application and development have already been indicated.) What part will British chemical industry play both in supplying the home market and in competing for a reasonable share in the world market? So far as the plant and chemical-engineering technique are concerned, there appear to be no insuperable difficulties, but in view of some of the figures quoted, the essence of the problem in Britain is that of raw materials. If, however, British chemical industry is to have any real chance in the battle of plastics, strenuous efforts will have to be made to provide the raw materials required. In Britain the limited acreage of land must be devoted substantially to food crops, so production of alcohol from home-grown cereals is not an attractive proposition, nor are large crops of soya beans, although in the U.S.A. with vast areas of land Henry Ford has shown that these beans may constitute a valuable source of plastics raw material.

From Coal to Oil

During the past years coal and its by-products have yielded the bulk of the raw materials for the plastics industry, but wartime developments in the U.S.A. have altered the whole focus of this branch of synthetic chemistry slowly but inexorably towards oil. Benzene, formerly obtained almost exclusively from coal, is now furnished in increasing quantities by the oil-refining industry, while the most recent revolutionary development has been the pyrolysis of natural gas to give acetylene. If this development continues, as is virtually assured, a further handicap will be imposed on the industry in Britain where the 100,000 tons of crude oil produced annually from the newly-discovered fields are quite inadequate to form the basis of a synthetic industry.

No argument as to the advantages of the utilisation of oil-refinery by-products must be allowed to obscure the clamant need to utilise coal, which exists in abundance in this country as a source material for the plastics industry. In fact, so far as Britain is concerned, the ideal solution should embody a co-ordinated, scientific, and planned utilisation of coal, coal-carbonisation products, and petroleum-refinery products as source materials for a synthetic chemical industry. Closely allied to this is the necessity for cheap electric power to permit the large-scale manufacture of calcium carbide in this country. Acetylene, the source of many important intermediates in the plastics and synthetic rubber industries, will only be made available in the necessary quantities when a national scheme of hydro-electric power development has been put into operation.

In considering coal as a source material for plastics, a point of interest is the volume of evidence implying that coal itself is inherently plastic in nature. In 1929, Dr. H. E. Armstrong[5] stated that "some day probably we shall be forced to admit that coal, for the most part, is but a natural bakelite." Correlation of a great volume of data appears to show fairly definitely that the constitution of coal, in essence, may be based upon the structure assigned to a hardened phenolic resin. If coal is a high polymer, essentially plastic in nature, it is not unreasonable to

hope that new and important uses may be discovered in the form of processes which leave the carbon structure of the coal to a great extent unattacked. The advantages

flexibility is produced in the tubes, so enhancing their electrical properties. Butadiene, comprising 75 per cent. of the materials for Buna-S rubber, is another benzene deriva-

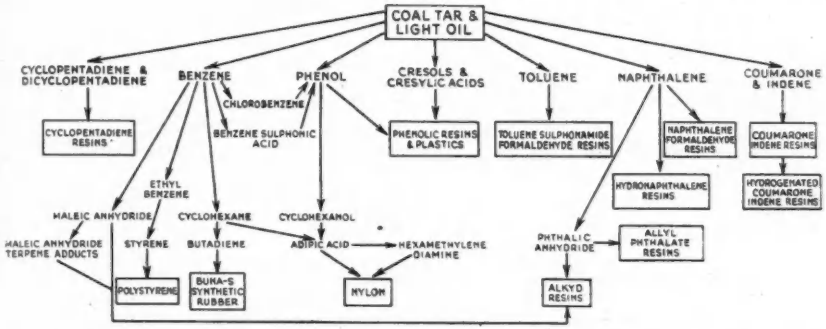


Fig. 1. Synthetic resins and plastics derived from coal tar and light oil (WAKEMAN and WEIL).

are obvious in developing a process capable of using substantially the whole of the coal substance for conversion into strong solid plastics instead of utilising merely the relatively small quantities of carbonisation by-products. Bennett[6] calculates that such a process would provide an outlet for 4 to 8 million tons of coal per year with a saving of imports of timber and iron ore to the value of £10-20 million per year.

Until the emergence of such a highly desirable process, coal may act as a source material for the plastics and synthetic rubber industries through a number of different channels. Classified roughly, these are the recovery and separation of liquid and gaseous products of carbonisation both low temperature and high temperature, and the use of coke for the manufacture of calcium carbide and in the water gas reactions.

Liquid By-products of Carbonisation

Up to date the liquid products of high-temperature carbonisation of coal have formed the most important source of plastics intermediates. Fig. 1 shows diagrammatically the derivation of plastics and synthetic resins from coal tar and light oil. Main products from the distillation of these materials are benzene, phenol, cresols and cresylic acids, toluene, naphthalene, and coumarone and indene. From benzene by combination with ethylene or propylene and subsequent pyrolysis, styrene and its polymeride polystyrene are obtained. Styrene comprises 25 per cent. by weight of the raw materials used for the production of Buna-S (GR-S) synthetic rubber. Polystyrene, resistant to chemicals and moisture, has been found an extremely effective insulator for cables. By suitable mechanical processes a certain degree of

tive, but during the war the bulk of the butadiene has been synthesised from alcohol and from petroleum refinery gases. Adipic acid, 0.62 lb. of which is required for the manufacture of each lb. of nylon, may be produced from benzene, but a more direct synthesis is possible from phenol as indicated in Fig. 1. Phthalic anhydride, obtained from naphthalene, is an important link in the manufacture of allyl phthalate resins and also in the industrially important group of the alkyd resins extensively used for surface coatings. Maleic anhydride, constituting about 10 per cent. of the raw materials utilised in the production of alkyd resins, is obtained from benzene. Coumarone-indene resins employed in rubber compounding, in terrazzo floor tiles, in printing inks, and in paints and lacquers, are produced exclusively from the appropriate coal-tar fractions.

Of all the resins obtained from coal tar and light oils, the phenolic resins on an actual tonnage basis constitute the most important group, being derived from phenols and cresols. As only about ½ lb. is obtained per ton of coal carbonised, the maximum direct production of 6000 tons of phenol from the 40 million tons of coal treated annually in carbonisation plants cannot even remotely meet the demands of the pharmaceutical field and the plastics industry. As a result it has been estimated[7] that over 75 per cent. of the phenol production is obtained by synthesis from benzene. Phenolic resins find very important industrial and engineering uses, 25 per cent. of the total production going to the manufacture of bearings, while another large percentage is absorbed in the manufacture of gear wheels. In the United States gun butts and moulded shell nose-pieces have been produced in very large

quantities. In view of these facts the large tonnage production of phenolic resins and their vital importance in war are easily explained. A Russian demand[7] to the United States for the supply of 100 million lb. of phenol early in the war caused great consternation in view of the straitened supplies of this chemical.

Formamide, produced by the interaction of water-gas and ammonia, may serve for the production of the extremely important methacrylate transparent plastics, the intermediate hydrocyanic acid being obtained by the catalytic dehydration of formamide. Methanol forms an important link in the chain of cellulose production, both through methyl

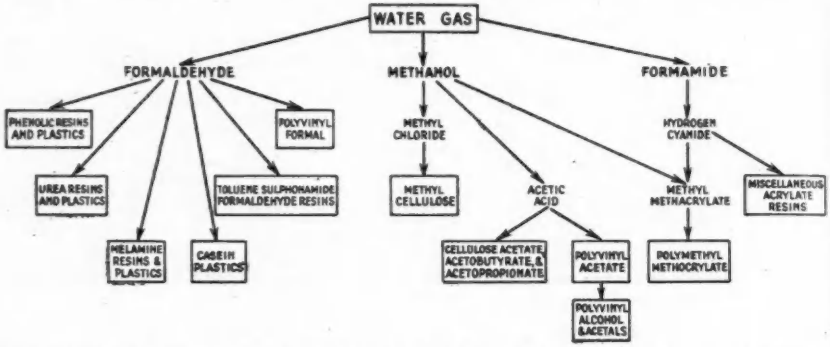


Fig. 2. Synthetic resins and plastics derived from water-gas (WAKEMAN and WEIL).

Coke may form a source material through two routes: by the water-gas reactions, and by manufacture of calcium carbide for the production of acetylene. From the water-gas synthesis the main products are methanol, formaldehyde, and formamide, the derivation of certain types of plastics from these materials being shown in Fig. 2. Formaldehyde is absorbed mainly with phenol in the manufacture of the phenolic resins, formaldehyde constituting over 30 per cent. of the weight of raw materials required. Smaller quantities are employed in the production of urea and melamine resins, urea plastics being particularly valuable for electrical fixtures where non-tracking must be considered.

chloride and acetic acid. Methyl cellulose production is absorbed in the manufacture of paper size and in the treatment of textiles.

Calcium carbide, as shown in Fig. 3, constitutes one of the most valuable source materials for the plastics industry, the synthesis of nine different types of plastics, rubbers, cellulose, and drying oils being possible. Two main avenues of synthesis are available, the first by the direct production of acetylene. By working through acetaldehyde, cellulose acetate and polyvinyl butyral may be obtained; through vinyl acetylene, neoprene synthetic rubber and synthetic drying oils are produced; while the chain vinyl acetate leads through polyvinyl acetate

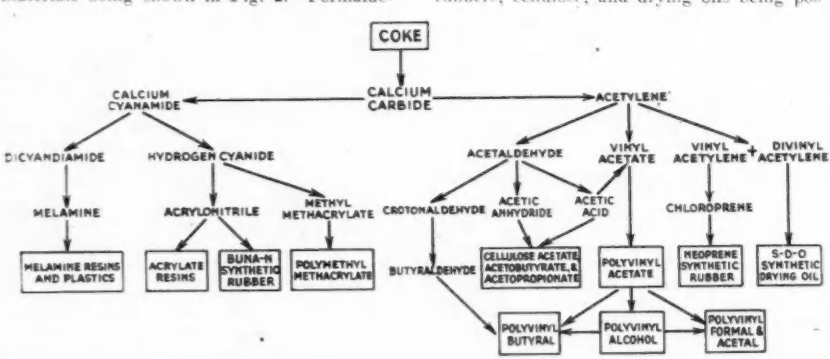


Fig. 3. Synthetic resins and plastics derived directly from coke (WAKEMAN and WEIL).

to polyvinyl butyral and acetal. Cellulose acetate, by far the most important of the thermoplastics, is employed in the form of transparent sheets for packaging or as fibres made into flexible electrical insulation, artificial leather, and acid-resisting pipes, tape and sheet. As will be evident from Fig. 4, acetylene may be employed as the source

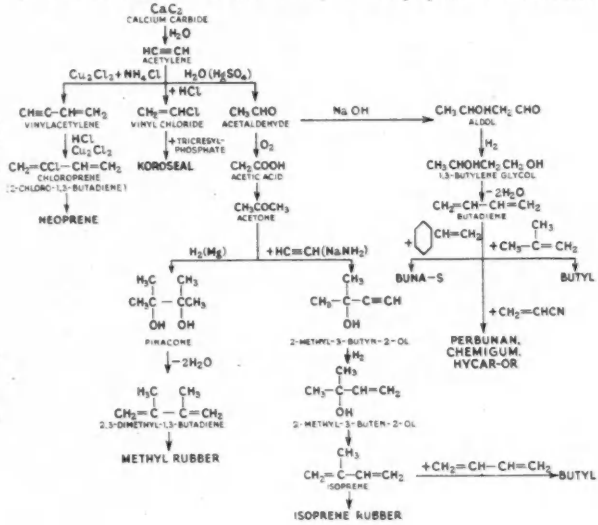
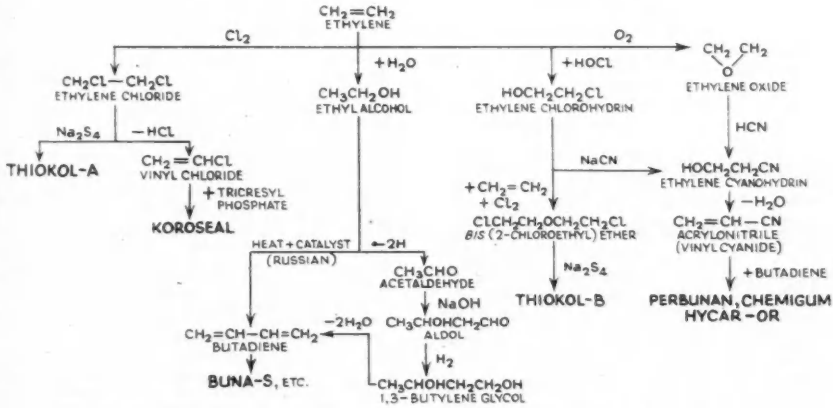


Fig. 4. Flow sheet of synthetic rubbers prepared with calcium carbide as the starting material (FISCHER).

Fig. 5 (below). Flow sheet of synthetic rubbers prepared with ethylene as the starting material (FISCHER).



for artificial silk. Polyvinyl butyral constitutes the basis of the vast majority of the inter-layers for "safety glass," over 3000 tons of this material having been absorbed in this form in the U.S.A. in 1941.

Vinyl derivatives—chloride, acetate, or chloroacetate—obtained by passing acetylene through the appropriate acid in presence of suitable catalysts, constitute some of the most important intermediates both for resins and synthetic rubbers. The polymers may be material of practically all the known synthetic rubbers, eight in all. Second, calcium cyanamide, produced by the interaction of calcium carbide and nitrogen, is not only an extremely valuable fertiliser but may serve as the basis for the production of several plastics and synthetic rubbers. Conversion of cyanamide to dicyandiamide gives the melamine resins, while conversion to hydrocyanic acid followed by transformation to methacrylate yields the important transparent

plastics. By obtaining acrylonitrile from hydrocyanic acid, Buna-N synthetic rubber may be produced.

These facts demonstrate beyond all doubt that calcium carbide is a key material for the plastics and synthetic rubber industries. At the same time it must be admitted that the vinyl derivatives may be produced from ethylene with practically no difference in cost. The recent sensational pyrolysis of methane and natural gas to yield acetylene itself may cause an almost complete re-orientation of certain important branches of the whole industry.

At the present time in Britain the only large-scale source of olefines (unsaturated gaseous hydrocarbons) is coal or coke-oven gas. From the total tonnage of coal carbonised in 1938—38 million tons—Levinstein's estimates that the main constituents contained in the gases amounted to:—

675,000 tons of hydrogen
2,500,000 tons of methane
400,000 tons of ethylene.

Of all the unsaturated hydrocarbons in coal and coke-oven gas ethylene is by far the most plentiful, although it represents only a few per cent. of the total gas volume. Considerable weight attaches to Levinstein's[5] proposals to extract the ethylene particularly from coke-oven gas. As he points out, polyvinyl chloride costs at the present time £500 per ton, although the price in the U.S.A.—40 cents per lb.—is less than half the British price. Separation of the three major constituents in the gas may be effected by Linde fractional liquefaction plant, as has been done in large coke-oven plants in the Ruhr and at Kharkov. The vital part which separated ethylene is capable of playing in the production of various synthetic rubbers—mainly for chemical and other specialised purposes—is shown by the flow sheet[5] in Fig. 5.

(To be continued.)

Control Orders Revoked

Fluorspar

THE Minister of Supply has made the Control of Fluorspar (No. 2) (Revocation) Order, 1945 (S. R. & O. 1945, No. 624), which revokes the Control of Fluorspar (No. 1) Order, 1942, by which the disposal and acquisition of fluorspar containing more than 60 per cent. calcium fluoride was made subject to licence. All restrictions on the sale and purchase of fluorspar are thereby removed as from June 4.

Bonding Materials

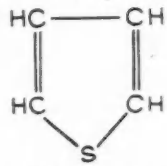
The Control of Foundry Bonding Materials (No. 2) (Revocation) Order, 1945 (S. R. & O. 1945, No. 625), revokes the No. 1 Order, 1941, by which the disposal and acquisition of bentonite, colbond and fullers' earth, except for certain uses, were made subject to licence.

Cheaper Thiophene

New U.S. Development

HITHERTO only small quantities of thiophene have been made available for laboratory work by costly chemical synthesis. The price in the U.S. is stated to be $54 per lb., while in this country 500 g. would probably cost something over £20, according to recent quotations for the small quantities customary. Now, however, the Socony Vacuum Oil Company, New York, announces that this chemical will become available as a commercial product and at a commercially attractive price. The process of manufacture is stated to be economical, and raw materials are plentiful. The company is already operating a laboratory pilot-plant unit, and a larger pilot plant is being constructed for a capacity of several barrels a day. The immediate plan is to make samples of thiophene available in order that its chemical potentialities may be explored.

This readier availability of thiophene may lead, in the U.S. at any rate, to wide developments in the manufacture of plastics, pharmaceuticals, and dyestuffs (*see Chem. Met. Eng.*, 1945, *52*, 3, 138). The reactions of thiophene resemble those of benzene, though different reaction conditions may be necessary; and the preparation of many products similar to those which are derived from benzene and its compounds may be developed with the thiophene ring:



substituted for the conventional six-carbon benzene ring. This fact presents numerous opportunities for altering the characteristics of many products such as the colour of dyestuffs, the physiological effects of medicinals, and the hardness, elasticity, brittleness, etc., of plastics.

Under certain conditions, thiophene also reacts with aldehydes, particularly formaldehyde, to form thermosetting resins. In this respect its behaviour may be likened to that of phenol although there are important differences. Nevertheless, in the condensation of phenol with aldehydes it is possible, under suitable reaction conditions, to replace phenol with thiophene in any proportion.

The Portland cement industry in Peru has shown remarkable growth in the past fifteen years, figures recently published showing that output has increased from 285,000 barrels in 1928 to 1,227,000 barrels in 1944.

American Patents

Some Points for Consideration

by S. T. MADELEY

AT the outset it will be well if we have clearly in our minds an appreciation of the main differences that exist between British patents and those in the U.S.A. A British patent may be applied for with a provisional specification or a complete specification in first instance. The former is the more common and has to be followed within twelve (or thirteen) months by a completion. The Patent Office makes a search into the novelty of the invention described, mostly among prior (mainly British) specifications. The examiners do not consider the inventiveness, the subject-matter, or the utility of the idea. Response to their objections can be postponed till acceptance is due. Eventually, in by far the larger number of cases which have reached the "complete" stage, the patent is granted. Sixteen years from the date of the filing of complete specification is the term of a patent, subject to the payment of renewal fees after the fourth year. Under Section 18 of the Patent Act the term of a patent can be extended by the Court, which in England means the Chancery Division of the High Court, on the basis of merit or of war loss alone. Proceedings for infringement or for revocation of the patent are taken in the aforesaid Court.

At the beginning of the war an Emergency Act was passed empowering the Comptroller-General of Patents, among other things, to grant extensions of time for taking steps in patent procedure, such as replying to official objections and paying fees and so on. He can also amend, revoke, or grant licences under patents owned by enemies or enemy subjects.

Procedure in the U.S.A.

Now American patent applications must be accompanied by a complete specification in the first instance. It its examination the Patent Office takes into consideration not only novelty, but also subject-matter (invention), and in this connection makes a world-wide investigation of prior patent specifications and technical literature. Six months from the date of the mailing is allowed for reply, no matter where the applicant may reside, and this time cannot be extended. The patent is granted for 17 years from the date of issue and is not subject to renewal fees. No Emergency Act has yet been passed, although one has been before Congress for some time. Assistance is, however, given to applicants who cannot because of the war take the necessary oath before the American Consul. The Patent Office will accept informal documents for examination purposes only; but a properly validated specification has to be lodged before the patent will be issued.

The six-months rule for response throws a great hardship on applicants who live a long way from the U.S.A., owing to delay in the mails. It has been suggested that, in cases where, because of the war, the response is not filed within the six months allowed and the application therefore becomes void, the case may be reinstated on appeal to the Commissioner who would use his powers benevolently. American legislation does not lay down any specific period within which American applications must be accepted.

If a British provisional specification does not, in the opinion of the American Courts, adequately disclose the subject-matter claimed in the corresponding U.S. specification, this may, in case of litigation, invalidate the American patent, if filed under the International Convention.

Re-examination

A U.S. patent can be re-examined after grant, in certain circumstance, with a view to widening the claims; this is contrary to British practice. Perhaps this may afford a means for obtaining more satisfactory claims, where inadequate ones have been granted and owing to war conditions. Action in this respect should be taken within two years of grant.

Owing, apparently, to there being at present no American Emergency Act, the British Patent Office has temporarily suspended action under Section 6 of our own Emergency Act where the benefits of that provision have been invoked on behalf of applications from the U.S.A. which have been filed late owing to the war and claim priority under the International Convention.

Before a British subject resident in Great Britain can file a patent application in the U.S.A., permission has to be obtained from the British Patent Office (*i.e.*, the British Government). All outgoing correspondence in connection with such applications must pass the Patent Office Censor. When the Admiralty, the Ministry of Aircraft Production, or the Ministry of Supply are interested in an application of this kind they insist on the applicant agreeing that he and his successors in title shall hold themselves free to grant what licences are required by the British or American Government concerning manufacture in the U.S.A. for war purposes, on agreed terms. In addition, if the Commissioner of Patents issues a secrecy

order in respect of a U.S. application as above mentioned, that invention must be tendered for the use of the U.S. Government. However, written permission from the British Department concerned is required before the applicant can make a claim against the U.S. Government.

Rights under U.S. patents which have already issued (been granted), and which belong to a British resident, may entail that person granting a licence, under orders from the British Government, which authorises the use of that right in the U.S.A. He may also be forbidden by the same authority to transfer that right without written permission or to enter into an agreement whereby he will be given information for assisting manufacture in the U.S.A. To this rule there are exceptions.

At the present time the British Patent Act is under review by a Patents Committee appointed by the Board of Trade. Oral and written evidence is being collected by that committee bearing upon the effect of our patents in this country's internal trade and export market. Published evidence goes to show that, in general, patents have not been used harmfully in this direction, and such abuse as does exist is mainly in connection with chemical patents. For this substantial freedom from damage to the public interest it is thought that credit should mainly be given to the way the legislature and the Courts deal with patentees, especially under Section 27 of the Patent Act which relates to compulsory licences.

Scope for Abuse of Rights

In the U.S.A. there is no statutory provision corresponding to the aforesaid section. Furthermore, patent cases may be tried in any of the State Courts before reaching the Supreme Court. These State Courts may have but little practical knowledge of patent procedure, and not only that; but the American practice of granting a multiplicity of independent claims often makes it very difficult to ascertain what is really protected by a patent. Consequently, there would appear to be more scope for abuse of patent rights in the United States than in the United Kingdom. Indeed, the Temporary National Economic Committee of Congress is investigating complaints in this direction. Severe penalties entailing loss of patent rights may be imposed under the Sherman Anti-Trust Law on those found guilty by the Courts of offences in this connection.

In cases where foreigners own U.S. patents and cannot exercise their rights because of the war, the patents may be taken over by the U.S. Government and licences granted thereunder. With reference to U.S. patent licences, the U.S. Government respects the rights of British subjects in the same way as it does those of Americans. Where the foreigners are enemy subjects and their inventions patented are likely to be of use economically or militarily for war purposes, they are seized and operated by the Alien Property Custodian.

Where enemy or enemy-subject countries are concerned, U.S. patent attorneys are not allowed to take action in patent procedure.

Newton Chambers Award

Conditions of Entry

READERS of THE CHEMICAL AGE will recall that Newton, Chambers & Co., Ltd., offered to the South Yorkshire Section of the Royal Institute of Chemistry a sum of £100 per annum for five years for the award of an annual prize for contributions to the subject of Chemistry and Industrial Welfare. The whole objective of the award is to encourage young chemists to make greater use of their knowledge of Industrial Welfare. Applications to compete are invited under the following conditions.

1. The 1945 competition is open to every Fellow, Associate, or Registered Student of the Institute who had not reached his 36th birthday by January 1, 1945.

2. The award is offered for an essay, paper or papers, published or unpublished, embodying the candidate's own observations, or experimental work, on some aspects of the application of chemistry to the promotion of industrial welfare. A critical examination of existing knowledge is admissible, provided that the conclusions reached constitute an addition to the knowledge of the subject.

3. Each candidate must transmit to the Hon. Sec., South Yorkshire Section, Royal Institute of Chemistry (A. Taylor, B.Sc., A.R.I.C., c/o Newton, Chambers & Co., Ltd., Thorncliffe Works, Sheffield), to reach him on or before December 31, 1945: (a) A formal letter of application to enter the competition, stating name, address, date of birth, and status in the Institute; (b) two copies of each paper submitted, together with a brief statement in duplicate indicating in what respect the paper advances knowledge of the application of chemistry to the promotion of industrial welfare; and (c) a declaration by the candidate that the work is his own, or in the case of joint papers, a statement signed by the candidate and his collaborators as to the extent to which the results and conclusions are the work of the candidate.

4. The decision of the Section Committee on any matter connected with the award of the prize is final. The committee may at its discretion divide or withhold the award.

5. The Committee may require a candidate to attend for interview.

6. The Committee reserves the right to publish the successful essay or paper (if not already published).

War Damage Compensation

Higher "Value Payments" Possible

THE end of the war in Europe is likely to have brought the time nearer when "value payments" will be made in connection with the War Damage Act, 1943. This provision, relatively little known, which will have a bearing on the amount of these payments, is explained below as being of interest to many readers.

Under this Act, there are two payments in clear cases (*i.e.*, of little or, on the other hand, of much damage), a "cost of works payment" where premises are repairable, and a "value payment" otherwise. But for other cases the War Damage Commission, which administers the scheme, must order a "value payment," if it is considered that putting the premises into the state they were in before the war damage occurred would cost more than would result from a "value payment," both repairing costs and values being taken as at March 31, 1939. The case is then considered, for the purposes of this appraisal, a "total loss" (in the words of the Act); and, where a "total loss" applies, a "value payment" must be made. It will be understood from this that the term "total loss" does not apply in a physical sense, but in an economic sense. Furthermore, it may be noted that roughly a "value payment" is the difference between the value of the premises before and after the damage (values as at March 31, 1939), thus broadly the pre-war value of the premises. But where a "cost of works payment" is scheduled, the actual amount of the payment is not necessarily the 1939 figure used for the appraising test, but an amount based on building costs, etc., current at the time the job is done.

The Special Provision

On the other hand, by the main provisions of the Act, a "value payment" is still to be made in accordance with values as at March 31, 1939, and this is where the special provision mentioned earlier comes in. By this section of the Act, it is provided that if, when the time comes for the discharge of value payments (a time to be specified in Treasury Regulations, in which respect it has been officially stated that some time at the end of the war is meant) in substantial volume or generally, it appears to the Commission that, having regard to circumstances arising since the passing of the first War Damage Act (March 26, 1941), the amount of the value payments, if based on 1939 values, would be inadequate, it must so report to the Government, who can then by Treasury Order (such an Order to be approved by the Commons, not the Lords) direct that increases shall be made. Such increases will be specified in the Order and will apply to any payments, whether made before or after the coming into force of the Order. It does not seem out of the way to suggest that having regard to the trend of values and prices since 1939, it is highly probable that the special provision will be put into operation, and that increases in payments beyond the 1939 values will result.

LETTER TO THE EDITOR

DDT and Gammexane

SIR,—Replies to my letter on the above subject from Mr. Hymas and Mr. Rogerson assumed that I had been testing full strength DDT against 0.2 per cent. Gammexane. I did not think that my letter conveyed this impression, but if it did let me say at once that the test was as nearly fair as I could make it. I had to extract the Gammexane from a powder by means of a solvent and I adjusted the DDT to, as nearly as I could determine, the same strength. The method of determining the strength was by killing flies. It was only after this that I carried out my experiments on what I described as the "persistence" effect, and DDT showed up very much better than Gammexane.

I was not really concerned with the relative merits of these things. My main point was that they should not be compared publicly at this stage. If it were true that Gammexane is three to five times more potent than DDT, then this is a very serious reflection upon the Government authorities in their delousing operations, since they could have used but one-third the amount had they had Gammexane, or they could have multiplied the number of treatments by three and the world would have been that much further on. According to I.C.I. advertisements there has been and still is no scarcity of Gammexane, but the Government still continues to monopolise all the DDT, except what one can make for oneself.

I detected a note of resentment in Mr. Rogerson's letter, but I desire to be exonerated from any attempt to decry the I.C.I. product. If he, or any other chemist, would like a farmer's view on how farmers are treated by the chemical industry I shall be happy to furnish an article which might do a great deal of good. A grievance would possibly be found to lie on the side of the farmer.—Yours faithfully,

F. N. PICKETT, M.I.Mech.E.

Canada's first aluminium box-car was turned out by Canadian Pacific Railway and has started a series of test runs. The car is a 50-tonner, lined with wood, and weighs 4200 lb. less than its steel-sheathed counterpart.

Personal Notes

MR. J. M. OSBORNE has been appointed a director of Dorman, Long & Co.

DR. J. A. SMYTHE, reader in metallurgy at King's College, Newcastle, is retiring under the age limit.

MR. J. HADFIELD has been appointed chairman of Derbyshire Stone, Ltd., in place of the late Mr. S. D. Clements.

MR. C. E. HOLMSTROM, at present a special director of Firth-Vickers Stainless Steels, Ltd., has been appointed deputy managing director.

MR. T. P. NORRIS, divisional labour manager, I.C.I., Ltd., Billingham, is to be chief personnel officer with Vickers, Ltd., with headquarters in London.

SIR HAROLD HARTLEY, who has served as chairman of the council of British Cast Iron Research Association since 1936, has been nominated president-designate following the death of Mr. P. Pritchard.

MR. A. J. LYDDON, late chief engineer in the Ministry of War Transport, has been appointed director of the Federation of the recently formed Coated Macadam Industries.

MESSRS. J. EWING, P. A. HOLT, and F. SHARPLES were elected joint managing directors of the Bradford Dyers' Association in succession to Mr. W. DOUGLAS, now chairman and managing director.

DR. R. V. V. NICHOLLS, of McGill University, was elected chairman of the Montreal section of the Chemical Institute of Canada at its first annual meeting. MR. J. D. LORIMER is hon. treasurer, and MR. ADOLPH MONSAROFF hon. secretary.

DR. MARSTON T. BOGERT, professor emeritus of organic chemistry at Columbia University, has been elected an honorary member of the American Institute of Chemists, "for outstanding service to the profession of chemists and the science of chemistry."

At last week's meeting of the Electrodepositors' Technical Society, held in London, DR. S. WERNICK was elected to succeed Dr. J. R. I. Hepburn as president. The year's vice-presidents are DR. G. E. GARDAM, DR. H. J. T. ELLINGHAM, and MR. F. L. JAMES (also hon. treasurer), and MR. F. W. BAIER was appointed deputy hon. secretary.

MR. A. WILSON, chairman of the delegate board of directors of I.C.I. (Explosives), retired on May 31, after 51 years' service. In the last war he planned and laid out several munition factories, and in recent years was responsible for the organisation of seven new plants in South-West Scotland. He is succeeded by Dr. J. W. MCDAVID, formerly joint managing director of the division.

DR. STEPHEN MIALL, who has been editor of *Chemistry and Industry* since 1923, retired on June 1, and is succeeded by MR. T. W. JONES, who for many years has been editor of the *Industrial Chemist*. MR. T. F. BURTON, who has edited *Transactions* since 1915 and the *Annual Reports of the Progress of Applied Chemistry* since their inception in 1916, becomes full-time editor and secretary of the Bureau of Abstracts.

At the annual meeting of the Institute of Physics on June 4, the following were elected to take office on October 1: *President*, SIR FRANK SMITH; *vice-president*, PROFESSOR A. M. TYNDALL; *hon. treasurer*, MAJOR C. E. S. PHILLIPS; *hon. secretary*, PROFESSOR J. A. CROWTHER. *Members of the Board*: DR. B. P. DUDDING, MR. A. J. MADDOCK, PROFESSOR W. SUCKSMITH, and DR. C. SYKES. Professor C. T. R. Wilson, F.R.S., was elected an honorary Fellow of the Institute.

Obituary

MR. R. SHAW PATERSON, who died at Dunoon on May 29, was for many years with Leisler Bock & Co., Ltd., chemical merchants, of Glasgow, where he was responsible for the export department.

Pest Control

New Officials Elected

AT the annual meeting of the Association of British Insecticide Manufacturers, the following were elected as officers and committee for the ensuing year: *Chairman*: MR. T. A. ROBERTSON (Plant Protection, Ltd.); *vice-chairman*H DR. T. F. WEST (Stafford Allen & Sons, Ltd.); *hon. treasurer*: MR. E. Z. BOLT (G. H. Richards & Co., Ltd.); *hon. auditor*: MR. R. V. CRAVEN (W. J. Craven & Co., Ltd.). *Executive committee*: Messrs. A. F. Berk (F. W. Berk & Co., Ltd.), R. A. Blair (Burt, Boulton & Haywood, Ltd.), E. T. Buggé (Buggés Insecticides, Ltd.), H. J. Jones (Hemingway & Co., Ltd.), J. S. Mitchell (Murphy Chemical Co., Ltd.), J. E. R. Simons (Geo. Monro, Ltd.).

The Industrial Pest Control Association has elected the following officers and committee for the ensuing year: *President*: DR E. HOLMES (Plant Protection, Ltd.); *vice-president*: MR. A. F. MCINTOSH (Thomas Harley, Ltd.); *hon. treasurer*: MR. S. F. SPRANGE (London Fumigation Co., Ltd.). *Executive committee*: Messrs. K. G. Anker-Peterson (British Ratin Co., Ltd.), F. H. Braybrook (Technical Products, Ltd.), F. P. Coyne (I.C.I., Ltd.), G. McLaren (Haller Laboratories, Ltd.), J. E. R Simons (Geo. Munro, Ltd.).

Parliamentary Topics

British Metal Corporation

IN the House of Commons last week, Mr. Horabin asked the Minister of Supply whether the arrangement between H.M. Government and the British Metal Corporation for the import and distribution of certain non-ferrous raw materials during the war permitted that Corporation, by means of a subsidiary company wholly owned by it, to transact business for profit in the self-same materials for the supply and distribution of which it was embodied into the Ministry and is remunerated out of public funds.

Sir A. Duncan: The arrangement, while restricting business by the Corporation in this country, permitted a subsidiary company to carry on the business of selling abroad metals and materials which were purchased abroad, subject to their giving H.M. Government first refusal of any material.

Mepacrine Administration

Mr. Viant asked the Secretary of State for War whether officers or other ranks who have a strong objection to taking drugs, such as mepacrine, have the right to refuse to take this drug.

Sir J. Grigg: Officers and other ranks have no right to refuse to obey a lawful order, and Commanders-in-Chief are entitled to issue orders to ensure that their troops are fighting fit and kept free from disease. Neither religious scruples, however *bona fide*, nor dislike of such unpleasant after-effects as it may produce, afford justification for refusing to take mepacrine.

Quinine Supplies

Mr. Sorensen asked the Secretary of State for India the mortality rates for malaria in India during the past 10 years; to what extent it was attributable to the shortage of quinine; and what percentage of the 244,000 lb. of quinine in stock in April was available for civilian consumption.

Mr. Amery: It is not possible to give reliable figures of deaths in India specifically attributable to malaria, nor to estimate to what extent they might have been reduced by greater use of quinine. The supply of quinine until the Japanese occupation of Java was, broadly, equal to the demand, and supplies of synthetic substitutes have for some time been reaching India in substantial quantities. Of the 244,000 lb. of quinine in stock in April, 1944, 200,000 lb. was available for civilian consumption.

Replying to a supplementary question by Mr. Sorensen, whether a certain number of deaths have been attributable to the lack of quinine, the Secretary of State said that he was not aware of that fact.

General News—From Week to Week

The Council of King's College, Newcastle, accepted a scholarship in geology, valued at £200, offered by the Royal Dutch-Shell group. Another similar scholarship has also been offered to the University by this group.

A course of four lectures on patents, with particular reference to chemical patents, has recently been given to undergraduates and research students, in the Department of Chemistry, University of Liverpool, by Mr. H. E. Potts, vice-president of the Council.

The Ministry of Food announces that there will be no change in the existing prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the four weeks ending June 30.

The Ministry of Labour and the Foreign Office wish to thank the many applicants who responded to the recent advertisements for men with technical and scientific qualifications to control the industrial activities of Germany. Work of selection is still proceeding; applicants who have not heard from the Commission offering them employment by June 15 should assume that they have been unsuccessful, at least for the present.

"The Road to Victory," our article on the war effort of the British chemical industries (*see* THE CHEMICAL AGE, May 12), is being translated and reprinted in Russian by the Ministry of Information for *British Ally*, the official British news-sheet which circulates throughout the U.S.S.R.

The following Armament Research Department Electro-Deposition Memoranda are being released for publication: No. 7. Glossary of trade names for coating processes; No. 8. Methods of analysis of nickel depositing baths. Copies can be obtained on application to C.S.A.R. Liaison Officer, c/o S.T.A.M., R.1043 Shell Mex House, Strand, W.C.2.

It is now revealed by M.A.P. that the incendiary bomb was invented in the secrecy of I.C.I's Linlithgow factory. The gigantic requirements of these 4 lb. bombs necessitated two specially constructed factories. One was built at Bowhouse, in Ayrshire, and the other at St. Boswells, in Roxburghshire. At the peak of production, these two factories and the Linlithgow plant employed 4000 workers. The magnesium required was manufactured at Bellshill.

The lime subsidy payable in accordance with the Land Fertility Scheme will be increased this year for summer deliveries from the normal rate of 50 per cent. to 60 per cent. This increased rate will be paid only in respect of lime delivered under the scheme to occupiers of agricultural land in Great Britain and Northern Ireland during the period June 1 to September 15 (inclusive).

Operation "Fido" (Fog, Intensive Dispersal of) is the name given to the efficacious thermal method of dealing with fog on aircraft landing grounds, which was developed by the Petroleum Warfare Department on the initiative of the Prime Minister. Sir Harold Hartley presided over the scientific side of the process, and the chemical industry's share in its success is indicated by the announcement that the I.C.I. and the Anglo-Iranian Oil Co., as well as the Gas Light and Coke Co., the G.E.C., and other companies, co-operated in "Fido's" development.

Regarding the future of the china clay industry, it was reported at a meeting of the St. Austell Chamber of Commerce on Tuesday, May 29, that a satisfactory reply had been received by the M.P. for the division, Major Maurice Petherick, from the Minister of Works to his inquiry regarding the use of pressed steel instead of earthenware for sanitary fittings in temporary houses. Mr. Sandys had replied to Major Petherick that more than two-thirds of the temporary houses allocated up to date would have earthenware basins.

In searching for a reliable dry absorbent for sulphur dioxide for use in the determination of carbon in steels, Ronald Belcher, of Rotherham Technical College, has found only two effective reagents, namely manganese dioxide and silver permanganate (*J.S.C.I.*, 1945, *64*, 111). Either material will absorb the sulphur dioxide produced from steels containing as much as 0.73 per cent. of sulphur. Manganese dioxide has the advantage of cheapness and ease of preparation, but silver permanganate might find application in the determination of carbon in organic substances containing halogens as well as sulphur.

In order to bring selling prices of mica more closely into line with current purchase costs, the Ministry of Supply has decided to increase as from May 30, 1945, the prices at which mica is sold by its agents, Mica Distributors, Ltd., for United Kingdom consumption. The prices of all mica, except splittings and scrap (for grinding), have been raised by 50 per cent. on recent levels; the prices of mica splittings have been raised by 33⅓ per cent.; prices of scrap (for grinding) remain unchanged. Inquiries should be addressed to Mica Distributors, Ltd., Provincial House, 98-106 Cannon Street, London, E.C.4, or to the M.O.S., Mica Control, Euston House, Eversholt Street, London, N.W.1.

Publications of the Indian Lac Research Institute which have recently become available from the Research Laboratory of the London Shellac Research Bureau include Bulletins Nos. 59-62 and Research Note No. 33 (all by G. N. Bhattacharya), dealing with the dielectric properties of various lac and other resinous materials, and with the dipole moments of the chief constituents of lac and rosin; and two reprints, from *J. Ind. Chem. Soc.*, on the preparation of lac-oil varnish, and on the manufacture of thiourea.

Foreign News

Oilfields in Borneo are to be rehabilitated with U.S. equipment. American companies will start operations as soon as the military situation warrants.

Exports of cod-liver oil from Newfoundland in 1944 amounted to 314,538 imperial gallons, compared with 331,088 imperial gallons in 1943.

Greek excise or consumption taxes have been increased on caustic soda to 25 drachmas per kg. and on carbonate of soda and caustic potash to 20 drachmas per kg.

Brazilian production and export of manganese ore has increased from 24,900 tons in 1933 to more than 450,000 in 1944, largely stimulated by the war. From 1940 onwards, exports have gone almost entirely to the U.S.A.

Synthetic rubber production began in Sweden during March, at a rate of 1600 tons annually. The product, called Svedopren, is named in honour of Professor The Svedberg, Nobel Prize winner, who originated the process used.

In Alberta, a permit has been issued for the erection of a gypsum plant to cost $250,000. It will be operated under the name of Western Gypsum Products, Ltd. Gypsum rock will be brought in by rail from the Crow's Nest Pass in south-western Alberta.

A detailed investigation was made recently by the University of British Columbia of cobalt ore deposits which have been known for years to exist on Nickel Plate Mountain and at the Little Gem Mine. From 50 to 100 tons of cobalt oxide, it is stated, could be produced on an economic basis at present prices.

The production of glycerin by Ford's strain of *Bacillus subtilis* in the presence of glucose is reported by Neish, Blackwood, and Ledingham in *Canad. J. Res.* Apparently this is the first time that anyone has noted that a microbe can break down a carbohydrate into glycerin. The Germans produced glycerin some years ago by letting yeast ferment, and moulds can produce alcohol in a similar way. But yeast and moulds are not bacteria.

Forthcoming Events

June 9. Association of Scientific Workers (Leeds Branch). Philosophical Hall, City Museum, Park Row, Leeds. 2.30 p.m.-5.30 p.m.: Open conference: "Science and Education." Opening speaker: Sir Robert Watson-Watt, F.R.S.

June 12. Chemical Engineering Group (S.C.I.) and **The Institution of Chemical Engineers.** Rooms of the Geological Society, Burlington House, Piccadilly, W.1. 2.30 p.m. Mr. L. W. Needham and Mr. S. Lynch: "The Use of Suspensions as Heavy Liquids."

June 22-24. Royal Society for the Prevention of Accidents. National Safety Congress (Industrial Sessions) in London. Details of the programme will be included in our "Safety First" pages next week.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

F. W. GILDER & CO., LTD., London, S.W., manufacturers of polishes, etc. (M., 9/6/45.) May 3, £1065 19s. 8d. charge (section 81, 1929 Act), to Westbourne Park Building Society; charged on 297 Haydons Road, Wimbledon. *Nil. January 12, 1944.

NORTH BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 9/6/45.) May 16, disposition by Mrs. C. N. Fry or Steedman, with consent granted in implement of a Trust Deed dated September 12, 1934; charged on land with Hazelcroft and other buildings thereon at Achintore, Fort William. *—. March 28, 1944.

RILEY'S CHEMICALS & COLOURS, LTD., Clayton-le-Moors. (M., 9/6/45.) May 16, mortgage and charge and a mortgage, to Midland Bank, Ltd., each securing all moneys due or to become due to the bank; respectively charged on Oakenshaw, Clayton-le-Moors, and general charge, and on 411/413 Whalley Road, Clayton-le-Moors, and fixtures. *£949. December 29, 1943.

Company Winding-Up

COLOUR TARS, LTD., London, W. (C.W.U., 9/6/45.) Winding-up order, May 14.

Receivership

STILVO, LTD. (formerly Balla Products Co., Ltd.). (R., 9/6/45.) S. Kershen, of Craven House, W.C.2, was appointed receiver and manager on May 4, 1945, under powers contained in debentures dated April 11 and May 12, 1944.

Bankruptcy Information

WILSON, CYRIL CHARLES RANDOLF, 3 Church Street, Twickenham, Middlesex, and LUCAS, EDMUND LESLIE, The Wilderness, West Hyde, Rickmansworth, Herts, lately carrying on business as "The Middlesex Chemical Company," at 6 Ye Corner, Chalk Hill, Oxhey, and Rigby House, 14a High Street, Watford, Herts, chemical manufacturers. (R.O., 9/6/45.) Receiving order, May 3. Creditor's petition.

Company News

Townmead Products, Ltd., Unilever House, Blackfriars, London, E.C.4, have changed their name to British Edible Oils, Ltd.

Tate and Lyle, Ltd., have given notice to redeem, on September 30, 1945, at par, the whole of their outstanding 5½ per cent. mortgage debenture stock amounting to £1,089,057.

Hylab Laboratories, Ltd., Dorchester, have increased their nominal capital beyond the registered capital of £100 by the addition of £9900 £1 shares.

The Shell Transport & Trading Co., Ltd., reports a net profit, for 1944, of £1,944,922 (£1,973,301), and is paying a final dividend of 2½ per cent., making 5 per cent. (same).

Goodlass Wall & Lead Industries, Ltd., report a net profit, for 1944, of £220,000 (£197,000). A dividend of 9 per cent. (7 per cent.) has been declared.

British Alkaloids, Ltd., report a gross trading profit, for the year ended March 31, of £173,731 (£190,730). Net profit is £4751 (£4927). The dividend is maintained at 30 per cent.

The Cape Asbestos Co., Ltd., reports a profit, before taxation, for 1944, of £150,678 (£115,250). A final ordinary of 15 per cent. (12½ per cent.) makes a total of 17½ per cent. (15 per cent.)

Chemical and Allied Stocks and Shares

BUSINESS in stock markets has continued on a moderate scale, but the undertone was confident with an upward trend under the lead of Industrials. Although there has again been a prevailing disposition to await the result of the General Election, very little selling was in evidence. Imperial Chemical strengthened to 38s. 9d., and Dunlop Rubber at 50s. 3d responded to the chairman's statement regarding prospects and demand for the com-

pany's products. Radiations at 59s. 6d. were better, also United Molasses at 43s., and British Plaster Board at 38s., while the units of the Distillers Co. rose further to 117s. on expectations of good results. Turner & Newall at 81s. 6d. also moved higher, while British Oxygen were 86s. 3d., and Metal Box shares at 90s. 9d. responded to the better market tendency.

British Aluminium at 44s. 1½d. rallied, while Associated Cement at 60s. 3d. were unaffected by the announcement that the results can be expected at a later date on this occasion. Crittall Manufacturing at 27s. 7½d. improved, and, among electric equipments, British Insulated at 6¼ and Callender's Cable at 6 5/16 responded to the full merger terms and the higher interim dividends. The rally in iron-coal shares proceeded, aided by satisfaction with dividend announcements. Tredegar Iron "A" and "B" shares at 11s. 6d. and 17s. both gained 3s. on the dividend increase. Dorman Long at 27s. 4½d., Guest Keen at 37s. 3d., Hadfields at 29s. 9d., and Powell Duffryn at 23s 4½d. were better. Stewarts & Lloyds deferred moved up to 55s. 6d. Tube Investments were 5 5/16, with United Steel (25s. 4½d.), Staveley (49s. 3d.), and Thomas & Baldwins (12s. 6d.) also higher on balance. Allied Ironfounders at 50s. 9d. firmed up, awaiting the financial results. Goodlass Wall 10s. ordinary jumped to 21s. 10½d. on the higher dividend of 9 per cent., against 7 per cent. Pinchin Johnson were better at 39s. 9d., and Wall Paper Manufacturers deferred at 43s. 9d. Sentiment in regard to shares of companies connected with the building trades improved, partly because the easing of the control of capital issues will faciliate the raising of additional finance for essential post-war work.

In other directions, General Refractories were firmer at 16s. 6d. Courtaulds have been active around 55s. 6d., also British Celanese around 32s. 9d., and textiles generally were firm, with Fine Spinners 23s. 6d. xd., Bradford Dyers 23s. 10½d., Bleachers 13s. 6d., and Calico Printers 18s. 10½d. Among plastics, De La Rue were steady at £10¼, awaiting the dividend announcement, British Industrial Plastics 2s. shares 7s., and Erinoid 12s. 1½d. B. Laporte kept at 88s. 9d., and Monsanto Chemicals 5¼ per cent. preference at 23s. Greeff-Chemicals 5s. ordinary at 9s. 3d. were steady, awaiting the results. Elsewhere, British Drug Houses were 31s. 9d., Burt Boulton 27s., and Cellon 5s. ordinary 26s. British Glues & Chemicals 4s. ordinary continued at 10s. 6d. pending the dividend announcement. Business up to £5¼ was recorded in W. J. Bush 5 per cent. £5 preference shares.

Boots Drug were firmer at 56s. 6d., with Timothy Whites 42s. 6d., and Sangers 30s. 6d. Beechams Pills deferred moved up to 19s. 9d. on the company's latest acquisition. Griffiths Hughes at 39s. held their rise on the increased dividend. Elsewhere, Barry & Staines were steadier at 5s. 3d., with Nairn & Greenwich 76s. 3d. Fisons were 50s. 7½d., and United Glass Bottle 77s. 6d. Triplex Glass 10s. ordinary have changed hands at 41s. Gas Light & Coke ordinary were 22s. 3d. Oil shares became less firm following earlier gains

British Chemical Prices

Market Reports

TRADING conditions in the London general chemicals market are gradually returning to normal after the Whitsun holiday and a fair amount of fresh inquiry has been reported. Contract deliveries are going forward steadily and no price changes have been reported. In the soda products section, nitrite of soda and hyposulphite of soda are steady, while acetate of soda and chlorate of soda are attracting a fair amount of attention. A good inquiry is reported for supplies of bicarbonate of soda, glauber salt and salt cake, while offers of bichromate of soda are quickly taken up. In the potash section, liquid caustic continues in short supply, while a steady trade is passing in acid phosphate of potash. Permanganate of potash is a good market and the demand for yellow prussiate of potash continues in excess of available supplies. In other directions, there is a steady call for supplies of British-made formaldehyde and peroxide of hydrogen. In the coal-tar products section, the market is quiet, although a moderate amount of fresh inquiry is reported.

MANCHESTER.—Heavy chemicals for the textile bleaching, dyeing and finishing trades have been in steady demand against contracts on the Manchester market during the past week, and a certain amount of new business in these and in other industrial chemicals has also been reported, buying having included lump alum, sulphate of alumina, borax, carbonate and bicarbonate of ammonia, and the heavy acids. The chemical market generally remains on a firm basis. For most descriptions of coal-tar products deliveries of materials already bought, especially creosote oil and some of the light distillates, are going forward steadily. Here again, the market is strong and the probability of an early rise in prices of benzol and other light materials is being discussed.

GLASGOW.—In the Scottish heavy chemical trade there has been an improvement during the past week for home business. Prices remain firm, with no actual changes to report. Export inquiries are being received regularly.

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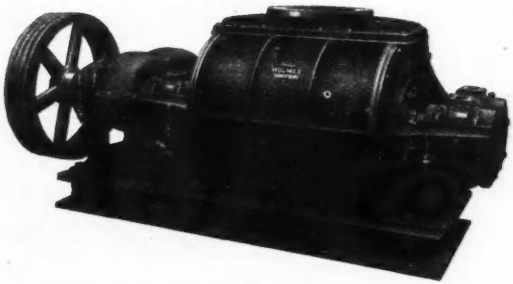

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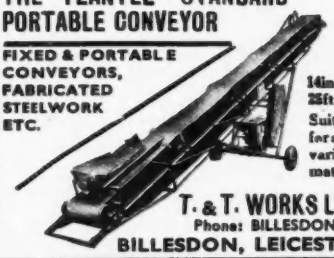

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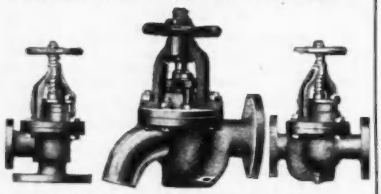

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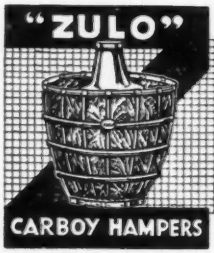

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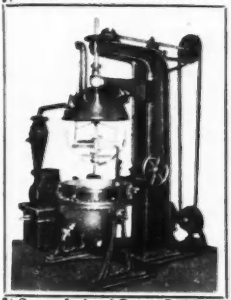

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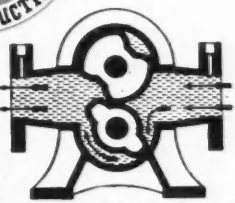

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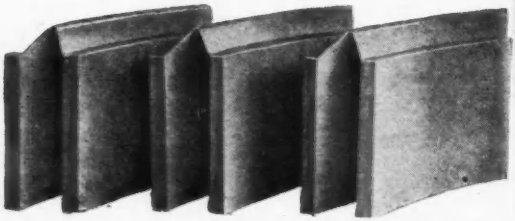

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